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The Cryosphere Discussions

# *Interactive comment on* "The ERA5-Land Soil-Temperature Bias in Permafrost Regions" *by* Bin Cao et al.

**Anonymous Referee #3**

Received and published: 7 June 2020

This paper assesses the utility of ERA5L soil temperature products for permafrost studies by using a wide range of global station data from both permafrost and non-permafrost regions as well as detailed simulation experiments at a specific site. The authors find that ERA5L has large biases making the product problematic for permafrost studies. This study is a valuable contribution as we increasingly use reanalysis products for land surface modeling studies, especially at regional or global scales and insights into performance of these products are useful. Additionally, such studies may help to guide future developments in land surface schemes used in reanalyses. I recommend publishing after considering my (mainly minor) comments.

(in grammatical comments changes are CAPITALIZED)

1. l.3 "is predicted TO BE too warm...."



2. l.19 "Reanalysis, ASSIMILATES"

3. l.28 what is ERA5-Interim/Land? Seems a confusion of the products

4. l.29 "consistently cold BIASED."

5. l.54 I think the HTESSEL ref could do with a publication citation.

6. l.57 now available from 1981.

7. Section 2.2.1 what do B1 and B2 refer to?

8. l.71 is the node really at the lower boundary (0.07) in soil layer 1?

9. l.74 "These INCLUDE"

10. Section 2.3 and Table 1 are all stations boreholes? If so perhaps explicitly state that.

11. l.90-91 and driven by ERA-Interim air temperature.

12. l111-114: I don't quite understand the motivation for the two definitions of near-surface permafrost I think a sentence explaining why you do this would be helpful for the reader.

13. l129 "A linear model..."

14. l.137 What depth are these MAGT's? Averaged across time or space? Please provide a bit more detail here.

15. l.143 more prevalent snow and soil freezing in the model or in reality? Please clarify. If in reality, then permafrost regions do not necessarily have more prevalent snow than non-permafrost regions.

16. l.147 "While ERA5L does not have DATA allowing deep ALT values to be computed"

17. l.153 "(annually)" is it an annual average? Please clarify.

18 Figure 3 Interesting latitudinal trend in c,d. Can you shed more light on this in the discussion? I guess densification processes at high latitudes (badly represented wind?) What is driving the cold bias at low latitudes?

19. Figure 4 perhaps add the mean value that you cite in the text here.

20. l.170 "shows REMARKABLY"

21. l.194 "Even for A"

22. l.198 "This issue is KNOWN"

23. l.208 "as AN exponential..."

24. l.226 soil temperatureS MATCH..."

25. l.230 But what about the cold bias you see? the bias appears to evenly spread (figure3) why does this not give a similar spread in ALT estimates (Figure 4) and a related underestimation of ALT?

26, l.232. use of "low" here is confusing. you are biased to low densities, you do not have a low bias. I would say "a low-density bias" to make it clear.

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